Future Battlefield Warriors

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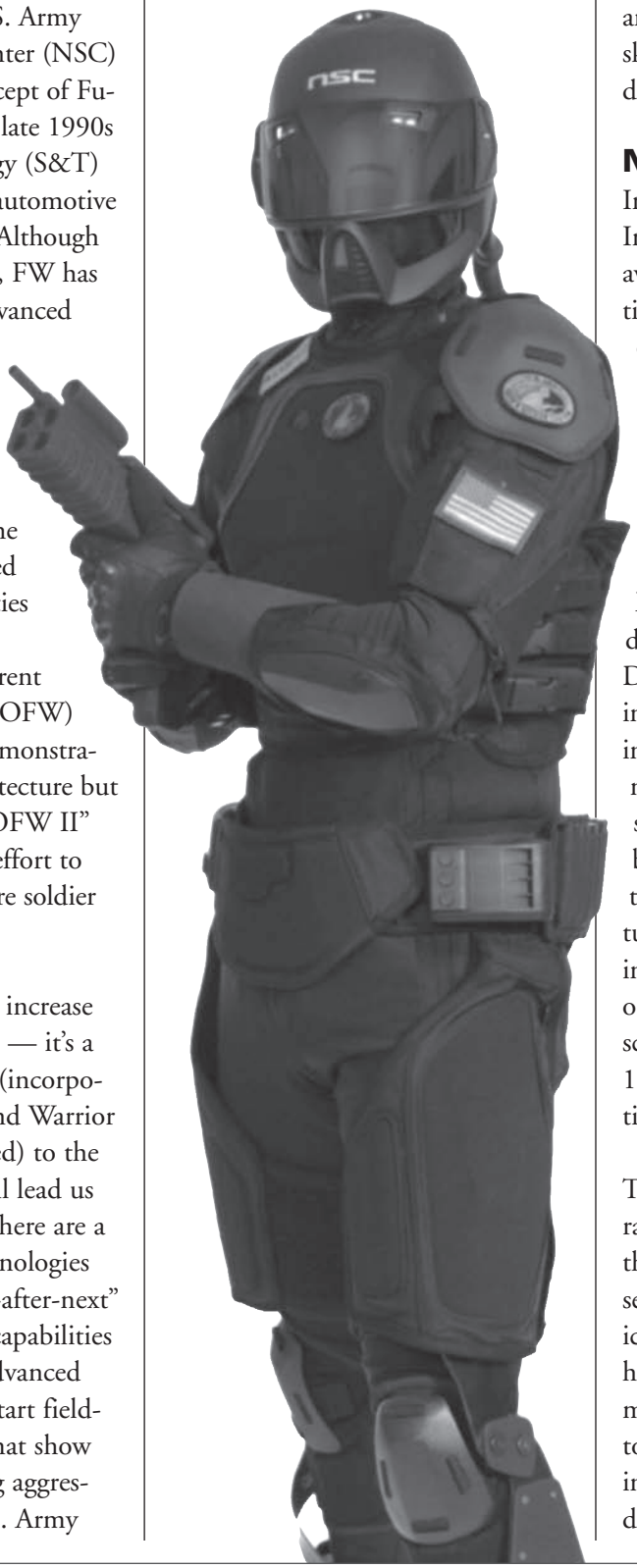
Engineers at the U.S. Army Natick Soldier Center (NSC) developed the concept of Future Warrior (FW) in the late 1990s as a science and technology (S&T) "platform" similar to the automotive industry's "concept car." Although not a formalized program, FW has become a way to track advanced military and commercial technologies to generate ideas about what warriors of 2025 may look like and the capabilities they may possess. The goal is to identify advanced technologies and capabilities that may not be mature enough to fit into the current Objective Force Warrior (OFW) Advanced Technology Demonstration (ATD) System/Architecture but show great promise for "OFW II" (i.e., the follow-on S&T effort to the current ATD) or future soldier systems even beyond that.



The FW is not simply an increase to the OFW's capabilities — it's a complete transformation (incorporating current soldier, Land Warrior Blocks I-III lessons learned) to the cutting-edge FW who will lead us into the next 20 years. There are a number of advanced technologies that will provide "decade-after-next" soldiers with leap-ahead capabilities over the Land Warrior Advanced Capability scheduled to start fielding in 2010. The areas that show greatest promise are being aggressively pursued by the U.S. Army and include nanotechnology, exoskeletons and full-spectrum individual protection.

Nanotechnology

In August 2001, the Massachusetts Institute of Technology (MIT) was awarded the U.S. Army's competition to research and develop nanotechnologies for fiber production. The Institute for Soldier Nanotechnology (ISN) began as a $50 million proposal, with industry contributing an additional $40 million in funds and equipment. ISN is a collaboration among MIT, the U.S. Army and other industrial organizations such as DuPont, Raytheon and Dow Corning. ISN's primary goal is to create innovations in nanoscience and nanotechnology in a variety of survivability-related areas that will be harvested by the partners for future Army application. Nanostructured or nanophase materials have internal structural features that are organized on the nanometer size scale. A nanometer is equal to 1/1,000,000,000 meter, or about 10 times the size of an atom.

This research will integrate a wide range of functions, including multithreat protection against ballistics, sensory attack, chemical and biological agents; climate control (cooling, heating and insulating); biomedical monitoring and load management to enable a revolutionary advance in soldier survivability through the development of novel materials for

integration into the FW systems. These technologies will translate into a one- or two-layered "smart" uniform that is soft and pliable like a traditional textile, yet provides ballistic and chemical protection, strength augmentation and adaptive (i.e., chameleon-like) camouflage. Concurrently, NSC is conducting nanotechnology research on nanocomposites to replace soft and hard body armor for protection, nanofiber membranes with nanoscale decontaminants for chemical decontamination, nanophotonics for laser eye protection and nanobarrier films for food packaging and protection.

Exoskeleton

Throughout history, one of the greatest challenges and limitations for soldiers, especially infantrymen, has been physical load. How much weight can a soldier carry and still accomplish his mission? As warfare becomes increasingly urban and advanced technologies make the battlespace wider and deeper, soldiers will be unable to depend on vehicles for protection, mobility, fire support and materiel resupply. Under current doctrine, soldiers are required to march 3-4 miles per hour carrying as much as 100-plus pounds of equipment. Exoskeleton-equipped soldiers would be capable of moving approximately three times faster while carrying more than double the current load with minimal actual stress to their bodies.

In Spring 2001, the Defense Advanced Research Projects Agency distributed the first grants from its $50 million, 5-year commitment contract to study and construct an exoskeleton. In nature, an exoskeleton is an external hard shell supportive covering of an animal. In this context, it's a powered mechanical, external support structure for soldiers. The system will assist pack-loaded locomotion, prolong locomotive endurance, increase locomotive speed and augment human strength. The system will be holistically designed with the soldier wearing it as an outer skin. Rather than operate it with joysticks, a haptic interface (a suite of sensors throughout the system would be activated by touch or contact to the skin) will allow the exoskeleton to become an extension of the soldier and his natural movements.

This pursuit has tremendous advantages for our soldiers. The exoskeleton would allow hard points to fasten armor for greater full-body protection, heavy weapons for increased lethality and the ability to carry greater loads (upwards of 400 pounds).

Other Technologies

While nanotechnology and the exoskeleton comprise two "pillars" of leading FW technologies, there are several other technologies that give the FW never-before-seen abilities. FW will take advantage of 3-D body scanning to produce a system that is tailored to each individual, from the electrospun combat uniform to the biomechanically engineered helmet, microturbine power generation, electrically conductive textiles capable of data and power transmission and active heating or cooling. Building on OF hardware and software systems, FW systems will act as remote triage stations. The uniform and onboard computer, tied into the tactical network, can recommend care and be teleoperated by medics to provide needed life-saving or life-sustaining measures. The FW will achieve oxygen exchange via a closed-loop breathing apparatus that negates the need for protective masks or filters. An onboard advanced personal weapons system with voice activation will contain five tubes of soft-launched, 15mm intelligent "fire-and-forget" munitions paired with a magazine of 4.6mm kinetic energy projectiles. NSC is also pursuing biotechnology research that will allow biosensors to be embedded in textiles to detect biological and chemical agents and toxic industrial chemicals and materials. NSC is also incorporating novel materials to enable textiles to self-decontaminate chemical agents and other toxic materials. These combined technologies will allow the FW to operate as an Army of One.

Soldiers, now viewed as a system-of-systems, will continue to be the foundation of future Army formations. The only way we can ensure soldiers are on the cutting edge of advancing science and technology is to constantly look toward future technology applications and adaptations. Today's and tomorrow's programs must address soldiers' concerns and feedback from the environments they work in. To be successful, FW must explore leading-edge technologies, making astute assumptions about future soldier requirements and battlespace employment. Only then can we maintain the combative edge of the unrivaled platform we call the Soldier.

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